optical amplifying unit.

34. (NEW) An optical amplifier receiving optical signals of first and second separate wavelength band wherein each wavelength band contains a plurality of optical signals of different wavelengths, said amplifier comprising:

a band demultiplexer providing a first band output and a second band output;

an amplifying unit amplifying the second band output; and

a band multiplexer combining the first band output and the amplified second band output.

35. (NEW) An optical amplifying system receiving optical signals of first and second separate wavelength band wherein each wavelength band contains a plurality of optical signals of different wavelengths, said system comprising:

an optical amplifier selectively amplifying the optical signals of the second wavelength band.

REMARKS

Reconsideration and allowance of the above-referenced application are respectfully requested.

I. STATUS OF THE CLAIMS

Claims 1, 18, 31, and 32 are amended herein.

New claims 33-35 are added.

In view of the above, it is respectfully submitted that claims 1-12, 14, and 18-35 are currently pending and under consideration.

II. REJECTION OF CLAIMS 1 AND 18-32 UNDER 35 U.S.C. § 102(B) AS BEING ANTICIPATED BY KIDORF ET AL. (USP# 6,081,366)

The present invention as recited, for example, in claim 1 as amended herein, relates to "an optical amplifier for amplifying wavelength division multiplexed signal light which has respective optical signals of a first wavelength band containing a plurality of optical signals with several wavelengths different from each other and a second wavelength band containing a plurality of optical signals with several wavelengths different from the wavelengths of the optical

signals contained in the first wavelength band," wherein "said optical amplifying means supplying said excitation light which has the wavelength capable of producing the Raman amplification with respect to the optical signals of said second wavelength to a Raman amplification producing medium...., so that wavelength division multiplexed signal light which contains optical signals of the second wavelength band which have been Raman amplified by said Raman amplification producing medium, are input to said optical amplifying means."

Kidorf discloses an optical fiber communication system with a distributed Raman amplifier and a remotely pumped erbium-doped fiber amplifier. In Fig. 6 and column 4, lines 18-25, Kidorf discloses that pump radiation from pump source 672 remotely pumps EDFA 652, pump radiation from pump 673 is provided to EDFAs 654 and 653, and that the transmission fiber provides Raman gain to the signal radiation that propagates in the direction from repeater 61 to repeater 62.

As indicated on page 2 of the Office Action, the Examiner believes that the claimed first and second wavelength bands as recited in claim 1 of the present application, correspond to "any arbitrary sub-bands in the amplification range" as disclosed by Kidorf.

However, Kidorf fails to disclose an optical amplifier that amplifies wavelength division multiplexed signal light with respect to optical signals of a first wavelength band containing a plurality of optical signals with several wavelengths different from each other, and a second wavelength band containing a plurality of optical signals with several wavelengths different from the wavelengths of the optical signals contained in the first wavelength band. Moreover, for example, Kidorf appears to amplify WDM signal light in the wavelength of 1.55μm (e.g., C band). See, for example, Figs. 8 and 9, column 2, lines 60-61, and column 3, lines 7-9 and 29-34 of Kidorf. Consequently, Kidorf fails to disclose or suggest amplifying optical signals in a wavelength band different from 1.55μm (e.g., C band). Therefore, Kidorf fails to disclose the claimed optical amplifier as recited in claim 1 of the present application, which amplifies WDM signal light containing optical signals of a first wavelength band (of, e.g., a C band) and a second wavelength band (of, e.g., an L band).

In light of the above, it is further submitted that Kidorf fails to disclose an optical amplifying means supplying excitation light which has the wavelength capable of producing Raman amplification with respect to the optical signals of the second wavelength to a Raman amplification producing medium as recited, for example, in claim 1 of the present application. In

the present application, the optical signals of the second wavelength band are Raman amplified in the WDM signal light that contains the respective optical signals of the first and second wavelength bands. Accordingly, the optical signals of the second wavelength band are selectively amplified with respect to the Raman amplification. In Kidorf, and as the Examiner states, it appears that optical signals of "any arbitrary sub-bands in the amplification range" are Raman amplified. Thus, it would appear that in Kidorf, a difference in Raman gain to "any arbitrary sub-bands" is small and in the present invention, the Raman gain is significant in that it is higher in the second wavelength band than in the first wavelength band.

Therefore, Kidorf does not disclose or suggest any of the features as recited in claim 1 of the present application.

Independent claims 18, 31, and 32 have also been amended herein to recite "an optical amplifier for amplifying wavelength division multiplexed signal light which has respective optical signals of a first wavelength band containing a plurality of optical signals with several wavelengths different from each other and a second wavelength band containing a plurality of optical signals with several wavelengths different from the wavelengths of the optical signals contained in the first wavelength band," which patentably distinguishes over the prior art.

Claims 19-30 depend from claim 18. Therefore, for at least the reasons that claim 18 distinguishes over the prior art, it is respectfully submitted that claims 19-30 distinguish over the prior art.

In view of the above, it is respectfully submitted that the rejection is overcome.

III. REJECTIONS OF THE CLAIMS 2, 3, 5, 6, 8, 10-12, AND 14 UNDER 35 U.S.C. § 103(A) OVER THE COMBINATIONS OF KIDORF, MA ET AL., SUN ET AL., MITSUDA ET AL., ANTOS ET AL., AND KOSAKA ET AL.

Claims 2, 3, 5, 6, 8, 10-12, and 14 depend from claim 1. Therefore, for at least the reasons that claim 1 distinguishes over the prior art, it is respectfully submitted that claims 2, 3, 5, 6, 8, 10-12, and 14 distinguish over the prior art.

In view of the above, it is respectfully submitted that the rejections to these claims are overcome.

IV. NEW CLAIM

New claims 33-35 are added. Claim 33 recites an optical amplifier comprising an optical

amplifying unit which "amplifies said wavelength division multiplexed signal light, and supplies an excitation light having a wavelength capable of producing a Raman amplification with respect to the optical signals of said second wavelength band to a Raman amplification producing medium..., so that wavelength division multiplexed signal light which contains optical signals of the second wavelength band which have been Raman amplified by said Raman amplification producing medium, are input to said optical amplifying unit," which distinguishes over the prior art.

Claim 34 recites an optical amplifier comprising "a band demultiplexer providing a first band output and a second band output" and "an amplifying unit amplifying the second band output," which distinguishes over the prior art. Claim 35 recites an optical amplifying system comprising "an optical amplifier selectively amplifying only the optical signals of the second wavelength band," which distinguishes over the prior art.

In view of the above, it is respectfully submitted that claims 33-35 patentably distinguish over the prior art.

V. CONCLUSION

In view of the foregoing amendments and remarks, it is respectfully submitted that each of the claims patentably distinguishes over the prior art, and therefore defines allowable subject matter. A prompt and favorable reconsideration of the rejection along with an indication of allowability of all pending claims are therefore respectfully requested.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Date: June 28, 2002

By: Derrick L. Fields

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please AMEND the following claims:

1. (TWICE AMENDED) An optical amplifier for amplifying wavelength division multiplexed signal light which [contains] has respective optical signals of a first wavelength band containing a plurality of optical signals with several wavelengths different from each other and a second wavelength band containing a plurality of optical signals with several wavelengths different from the wavelengths of the optical signals contained in the first wavelength band, comprising:

optical amplifying means amplifying said wavelength division multiplexed signal light using a rare earth element doped fiber to which excitation light is supplied,

wherein the excitation light used by said optical amplifying means has a wavelength capable of producing Raman amplification with respect to optical signals of said second wavelength band, and

said optical amplifying means supplying said excitation light which has the wavelength capable of producing the Raman amplification with respect to the optical signals of said second wavelength band to a Raman amplification producing medium which forms at least a part of an external transmission path arranged on a pre-stage side of said optical amplifying means, so that wavelength division multiplexed signal light which contains optical signals of the second wavelength band which have been Raman amplified by said Raman amplification producing medium, are input to said optical amplifying means.

2. (AS ONCE AMENDED) An optical amplifier according to claim 1,

wherein there is provided demultiplexing means demultiplexing said wavelength division multiplexed signal light into respective optical signals of a first wavelength band and a second wavelength band, and multiplexing means multiplexing respective optical signals of the first wavelength band and the second wavelength band which have been demultiplexed by said demultiplexing means,

said optical amplifying means has a first amplifying section amplifying optical signals of the first wavelength band which have been demultiplexed by said demultiplexing means, and a second amplifying section amplifying optical signals of the second wavelength band which have

been demultiplexed by said demultiplexing means, and

said optical amplifying means supplying via said demultiplexing means a part of said excitation light used in said first amplifying section to said Raman amplification producing medium, so that optical signals of the second wavelength band which have been Raman amplified by said Raman amplification producing medium, are input via said demultiplexing means to said second optical amplifying section.

3. (AS UNAMENDED) An optical amplifier according to claim 2, wherein when said first wavelength band is a 1550nm band and said second wavelength band is a 1580nm band, a wavelength of the excitation light used in said first optical amplifying section contains a 1480nm band.

4. (AS ONCE AMENDED) An optical amplifier according to claim 3, wherein said first optical amplifying section comprises an erbium doped fiber, at least one excitation light source generating excitation light of a 1480nm band, and an optical coupler supplying excitation light generated by said excitation light source to said erbium doped fiber from a rear side, wherein a part of said excitation light is passed through said erbium doped fiber and said demultiplexing means and supplied to said Raman amplification producing medium.

5. (AS ONCE AMENDED) An optical amplifier according to claim 1, wherein there is provided demultiplexing means demultiplexing said wavelength division multiplexed signal light into respective optical signals of a first wavelength band and a second wavelength band, and multiplexing means multiplexing respective optical signals of the first wavelength band and the second wavelength band which have been demultiplexed by said demultiplexing means,

said optical amplifying means has a pre-stage amplifying section collectively amplifying said wavelength division multiplexed signal light input to said demultiplexing means, and a second optical amplifying section amplifying only optical signals of the second wavelength band which have been demultiplexed by said demultiplexing means, and

said optical amplifying means supplying a part of said excitation light used in a part of said pre-stage optical amplifying section to said Raman amplification producing medium, wavelength division multiplexed signal light which contains optical signals of said second wavelength band which have been Raman amplified by said Raman amplification producing medium are input to said pre-stage optical amplifying section.

6. (AS UNAMENDED) An optical amplifier according to claim 5, wherein when said first wavelength band is a 1550nm band and said second wavelength band is a 1580nm band, a wavelength of the excitation light used in said pre-stage optical amplifying section contains a 1480nm band.

7. (AS ONCE AMENDED) An optical amplifier according to claim 6, wherein said pre-stage optical amplifying section comprises an erbium doped fiber, at least one excitation light source generating excitation light of a 1480nm band, and an optical coupler supplying excitation light generated by said excitation light source to said erbium doped fiber from a rear side, wherein a part of said excitation light is passed through said erbium doped fiber and supplied to said Raman amplification producing medium.

8. (AS UNAMENDED) An optical amplifier according to claim 1, wherein said Raman amplification producing medium is an optical fiber which is designed so that a non-linear effective cross section is small compared to a 1.3μm zero dispersion single mode fiber.

9. (AS ONCE AMENDED) An optical amplifier according to claim 1, wherein said external transmission path is of a hybrid transmission path formed by connecting a positive dispersion fiber having a positive wavelength dispersion value and a positive dispersion slope with respect to a signal light wavelength band, and a negative dispersion fiber having a negative wavelength dispersion value and a negative dispersion slope with respect to the signal light wavelength band, wherein one end on the side of said negative dispersion fiber is arranged at an input side of said optical amplifying means and functions as said Raman amplification producing medium.

10. (AS ONCE AMENDED) An optical amplifier according to claim 1, wherein there is provided optical power constant control means monitoring an output power of said wavelength division multiplexed signal light, and controlling an excitation light driving condition of said optical amplifying means so that said output power becomes constant.

11. (AS ONCE AMENDED) An optical amplifier according to claim 1, wherein there is provided gain constant control means monitoring a gain in said optical amplifying means, and

controlling an excitation light driving condition of said optical amplifying means so that said gain becomes constant.

12. (AS ONCE AMENDED) An optical amplifier according to claim 1, wherein there is provided supervisory control means processing a supervisory control signal transmitted together with said wavelength division multiplexed signal light.

14. (AS ONCE AMENDED) An optical amplifier according to claim 5 comprising:

first power monitor means monitoring the optical signal power of the first wavelength band which has been demultiplexed by said demultiplexing means;

second power monitor means monitoring the optical signal power of the second wavelength band which has been amplified by said second optical amplifying section; and

optical power deviation control means controlling the operation of at least one of said pre-stage optical amplifying section and said second optical amplifying section in response to the respective monitor results of the first and second power monitor means, so that the optical power deviation for the first and the second wavelength bands becomes constant.

18. (ONCE AMENDED) An optical amplifier for amplifying wavelength division multiplexed signal light which [contains] has respective optical signals of a first wavelength band containing a plurality of optical signals with several wavelengths different from each other and a second wavelength band containing a plurality of optical signals with several wavelengths different from the wavelengths of the optical signals contained in the first wavelength band, comprising:

an optical amplifying unit amplifying said wavelength division multiplexed signal light using a rare earth element doped fiber to which excitation light is supplied,

wherein the excitation light used by said optical amplifying unit has a wavelength capable of producing Raman amplification with respect to optical signals of said second wavelength band, and

said optical amplifying unit supplying said excitation light which has the wavelength capable of producing the Raman amplification with respect to the optical signals of said second wavelength band to a Raman amplification producing medium which forms at least a part of an external transmission path arranged on a pre-stage side of said optical amplifying unit, so that wavelength division multiplexed signal light which contains optical signals of the second

wavelength band which have been Raman amplified by said Raman amplification producing medium, are input to said optical amplifying unit.

19. (AS UNAMENDED) An optical amplifier according to claim 18,

wherein there is provided a demultiplexing unit demultiplexing said wavelength division multiplexed signal light into respective optical signals of a first wavelength band and a second wavelength band, and a multiplexing unit multiplexing respective optical signals of the first wavelength band and the second wavelength band which have been demultiplexed by said demultiplexing unit,

said optical amplifying unit has a first amplifying section amplifying optical signals of the first wavelength band which have been demultiplexed by said demultiplexing unit, and a second amplifying section amplifying optical signals of the second wavelength band which have been demultiplexed by said demultiplexing unit, and

said optical amplifying unit supplying via said demultiplexing unit a part of said excitation light used in said first amplifying section to said Raman amplification producing medium, so that optical signals of the second wavelength band which have been Raman amplified by said Raman amplification producing medium, are input via said demultiplexing unit to said second optical amplifying section.

20. (AS UNAMENDED) An optical amplifier according to claim 19, wherein when said first wavelength band is a 1550nm band and said second wavelength band is a 1580nm band, a wavelength of the excitation light used in said first optical amplifying section contains a 1480nm band.

21. (AS UNAMENDED) An optical amplifier according to claim 20, wherein said first optical amplifying section comprises an erbium doped fiber, at least one excitation light source generating excitation light of a 1480nm band, and an optical coupler supplying excitation light generated by said excitation light source to said erbium doped fiber from a rear side, wherein a part of said excitation light is passed through said erbium doped fiber and said demultiplexing unit and supplied to said Raman amplification producing medium.

22. (AS UNAMENDED) An optical amplifier according to claim 18, wherein there is provided a demultiplexing unit demultiplexing said wavelength division multiplexed signal light

into respective optical signals of a first wavelength band and a second wavelength band, and a multiplexing unit multiplexing respective optical signals of the first wavelength band and the second wavelength band which have been demultiplexed by said demultiplexing unit,

said optical amplifying unit has a pre-stage amplifying section collectively amplifying said wavelength division multiplexed signal light input to said demultiplexing unit, and a second optical amplifying section amplifying only optical signals of the second wavelength band which have been demultiplexed by said demultiplexing unit, and

said optical amplifying unit supplying a part of said excitation light used in a part of said pre-stage optical amplifying section to said Raman amplification producing medium, wavelength division multiplexed signal light which contains optical signals of said second wavelength band which have been Raman amplified by said Raman amplification producing medium are input to said pre-stage optical amplifying section.

23. (AS UNAMENDED) An optical amplifier according to claim 22, wherein when said first wavelength band is a 1550nm band and said second wavelength band is a 1580nm band, a wavelength of the excitation light used in said pre-stage optical amplifying section contains a 1480nm band.

24. (AS UNAMENDED) An optical amplifier according to claim 23, wherein said pre-stage optical amplifying section comprises:

an erbium doped fiber;

at least one excitation light source generating excitation light of a 1480nm band; and

an optical coupler supplying excitation light generated by said excitation light source to said erbium doped fiber from a rear side, wherein a part of said excitation light is passed through said erbium doped fiber and supplied to said Raman amplification producing medium.

25. (AS UNAMENDED) An optical amplifier according to claim 18, wherein said Raman amplification producing medium is an optical fiber which is designed so that a non-linear effective cross section is small compared to a 1.3μm zero dispersion single mode fiber.

26. (AS UNAMENDED) An optical amplifier according to claim 18, wherein said external transmission path is of a hybrid transmission path formed by connecting a positive dispersion fiber having a positive wavelength dispersion value and a positive dispersion slope

with respect to a signal light wavelength band, and a negative dispersion fiber having a negative wavelength dispersion value and a negative dispersion slope with respect to the signal light wavelength band, wherein one end on the side of said negative dispersion fiber is arranged at an input side of said optical amplifying unit and functions as said Raman amplification producing medium.

27. (AS UNAMENDED) An optical amplifier according to claim 18, wherein there is provided an optical power constant control unit monitoring an output power of said wavelength division multiplexed signal light, and controlling an excitation light driving condition of said optical amplifying unit so that said output power becomes constant.

28. (AS UNAMENDED) An optical amplifier according to claim 18, wherein there is provided a gain constant control unit monitoring a gain in said optical amplifying unit, and controlling an excitation light driving condition of said optical amplifying unit so that said gain becomes constant.

29. (AS UNAMENDED) An optical amplifier according to claim 18, wherein there is provided a supervisory control unit processing a supervisory control signal transmitted together with said wavelength division multiplexed signal light.

30. (AS UNAMENDED) An optical amplifier according to claim 22, further comprising:

a first power monitor unit monitoring the optical signal power of the first wavelength band which has been demultiplexed by said demultiplexing unit;

a second power monitor unit monitoring the optical signal power of the second wavelength band which has been amplified by said second optical amplifying section; and

an optical power deviation control unit controlling the operation of at least one of said pre-stage optical amplifying section and said second optical amplifying section in response to the respective monitor results of the first and second power monitor unit, so that the optical power deviation for the first and the second wavelength bands becomes constant.

31. (ONCE AMENDED) An optical amplifier for amplifying wavelength division multiplexed signal light which [contains] <u>has</u> respective optical signals of a first wavelength band <u>containing a plurality of optical signals with several wavelengths different from each other</u> and a

second wavelength band containing a plurality of optical signals with several wavelengths different from the wavelengths of the optical signals contained in the first wavelength band, comprising:

an optical amplifying unit amplifying said wavelength division multiplexed signal light, and supplying an excitation light having a wavelength capable of producing a Raman amplification with respect to the optical signals of said second wavelength band to a Raman amplification producing medium which forms at least a part of an external transmission path arranged on a pre-stage side of said optical amplifying unit, so that wavelength division multiplexed signal light which contains optical signals of the second wavelength band which have been Raman amplified by said Raman amplification producing medium, are input to said optical amplifying unit.

32. (ONCE AMENDED) An optical amplifier for amplifying wavelength division multiplexed signal light which [contains] has respective optical signals of a first wavelength band containing a plurality of optical signals with several wavelengths different from each other and a second wavelength band containing a plurality of optical signals with several wavelengths different from the wavelengths of the optical signals contained in the first wavelength band, comprising:

optical amplifying means amplifying said wavelength division multiplexed signal light, and supplying an excitation light having a wavelength capable of producing a Raman amplification with respect to the optical signals of said second wavelength band to a Raman amplification producing medium which forms at least a part of an external transmission path arranged on a pre-stage side of said optical amplifying means, so that wavelength division multiplexed signal light which contains optical signals of the second wavelength band which have been Raman amplified by said Raman amplification producing medium, are input to said optical amplifying means.

Please ADD the following NEW claims:

33. (NEW) An optical amplifier, comprising:

an optical amplifying unit to amplify wavelength division multiplexed signal light which has respective optical signals of a first wavelength band containing a plurality of optical signals with several wavelengths different from each other and a second wavelength band containing a

plurality of optical signals with several wavelengths different from the wavelengths of the optical signals contained in the first wavelength band, wherein,

said optical amplifying unit amplifies said wavelength division multiplexed signal light, and supplies an excitation light having a wavelength capable of producing a Raman amplification with respect to the optical signals of said second wavelength band to a Raman amplification producing medium which forms at least a part of an external transmission path arranged on a pre-stage side of said optical amplifying means, so that wavelength division multiplexed signal light which contains optical signals of the second wavelength band which have been Raman amplified by said Raman amplification producing medium, are input to said optical amplifying unit.

34. (NEW) An optical amplifier receiving optical signals of first and second separate wavelength band wherein each wavelength band contains a plurality of optical signals of different wavelengths, said amplifier comprising:

a band demultiplexer providing a first band output and a second band output;

an amplifying unit amplifying the second band output; and

a band multiplexer combining the first band output and the amplified second band output.

35. (NEW) An optical amplifying system receiving optical signals of first and second separate wavelength band wherein each wavelength band contains a plurality of optical signals of different wavelengths, said system comprising:

an optical amplifier selectively amplifying the optical signals of the second wavelength band.